Status Update of the Extreme Precipitation Forecast Improvement Project

Diana Stovern Ph. D.
CIRES/WPC/NWS

Introduction

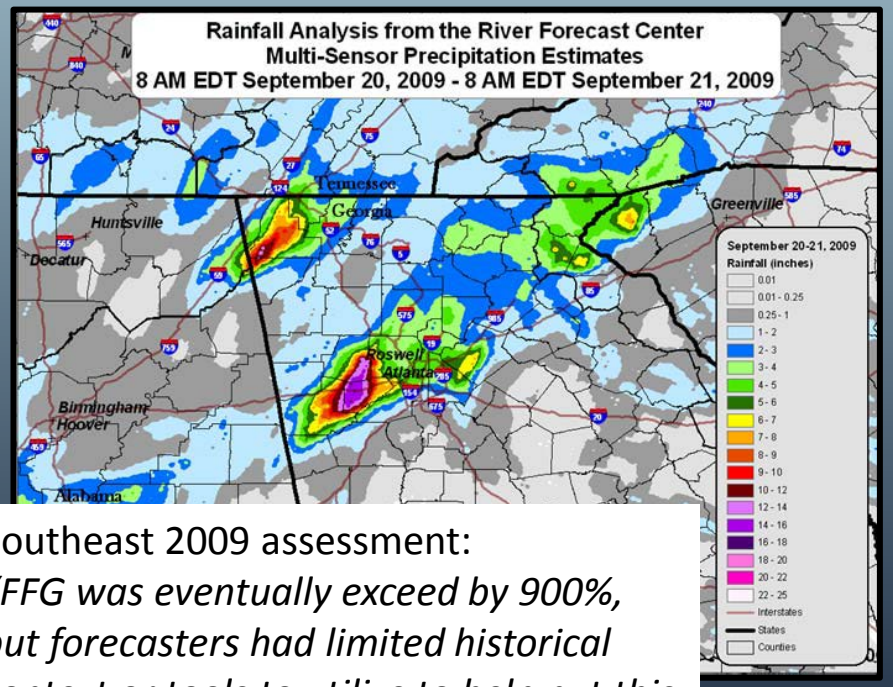
What is the Extreme Precipitation Forecast Improvement Project?

A national team consisting of WPC-leadership, NWS Science and Operation Officers (SOOs), and RFC representatives tasked by the Office of Science and Technology Integration (STI) to work **projects that help improve predictions and Impact-based Decisions Support Services (IDSS) associated with extreme precipitation events**.

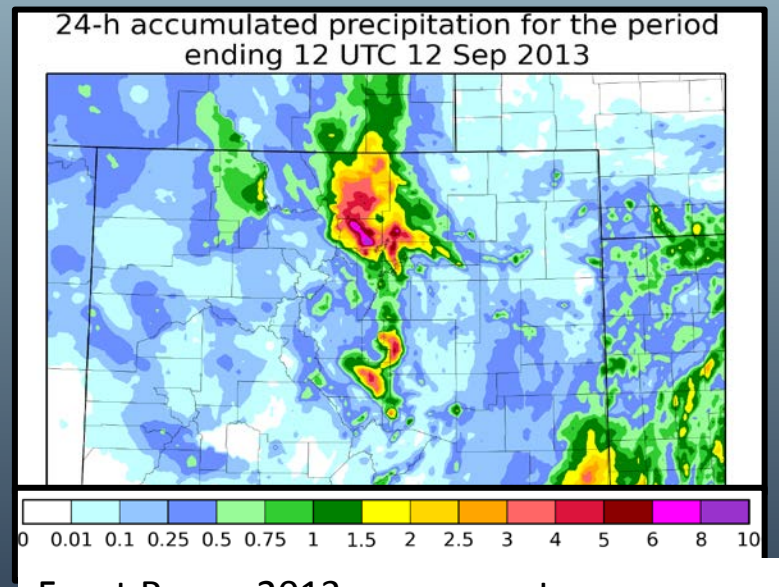
Primary Goal: Improve IDSS by increasing forecaster situational awareness leading up to an event.

Motivation

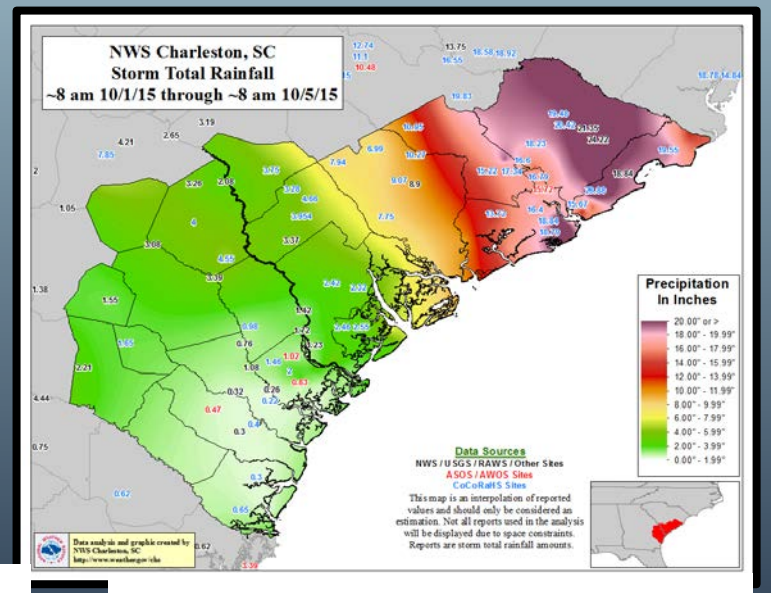
NWS Service Assessments conducted after high-impact precipitation events consistently highlight weaknesses in situational awareness, IDSS, collaboration and communication.



Southeast 2009 assessment:
"FFG was eventually exceed by 900%, but forecasters had limited historical context or tools to utilize to help put this information into impact perspective."



Front Range 2013 assessment:
"There was limited direct coordination regarding rainfall potential and flash flooding potential between WPC and the impacted WFOs and RFCs prior to this event."



South Carolina 2015 assessment:
"Information shared from WFOs directly to the public did not convey the full extent of risk"

Meet the Extreme QPF Collaboration Team!

Aka the “Extreme” Team

Team Leader
James Nelson – DTB Chief

WPC Rep
Mark Klein - SOO

RFC Rep (LMRFC)
Emilie Nipper

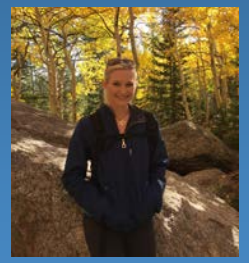
Southern Region Reps
Jon Zeitler (SOO-EWX)
Katie Landry (SH – HOU)

Western Region Rep
Stan Czyzyck (SOO-VEF)

Eastern Region Rep
Rich Grumm (SOO-CTP)

Central Region Rep
Dan Miller (SOO-DLH)

Alaska Region Rep
Sam Shea (SOO-AFC)



Dr. Diana Stovern
(CIRES/WPC)

Jon Zeitler
(SOO-EWX)

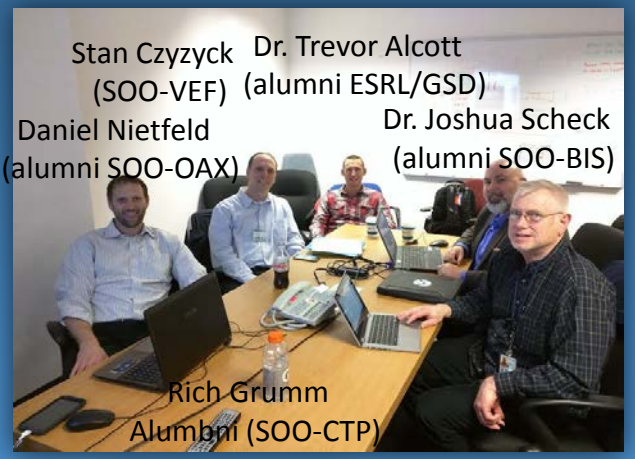
James Nelson
Chief of WPC’s
Developmental
Testbed (DTB)

Mark Klein
(SOO-WPC)

Emilie Nipper
(HAS - LMRFC)

Dan Miller
(SOO-DLH)

Sam Shea
(SOO-AFC)



Katie Landry
(Service Hydrologist
WFO-HOU)

The “R2O” path

From Collaboration to Operation!

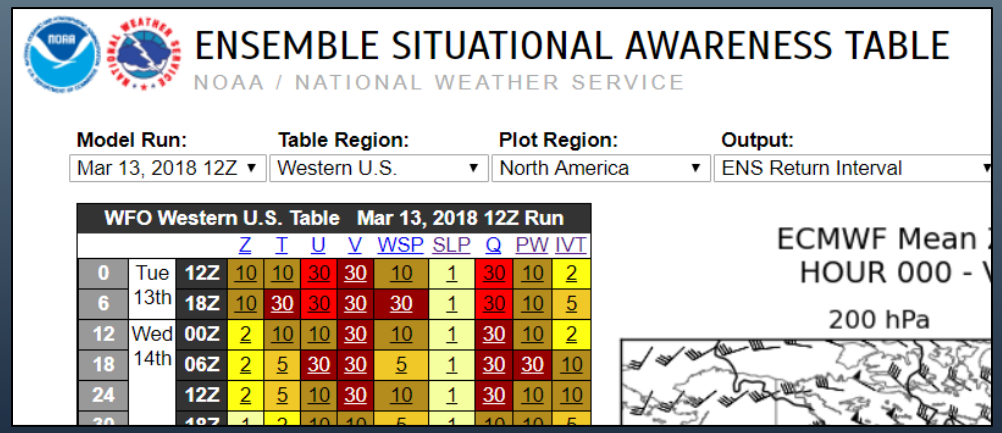
Research → Test → Implement → Improve

1. Explore the factors associated with severe flooding from precipitation

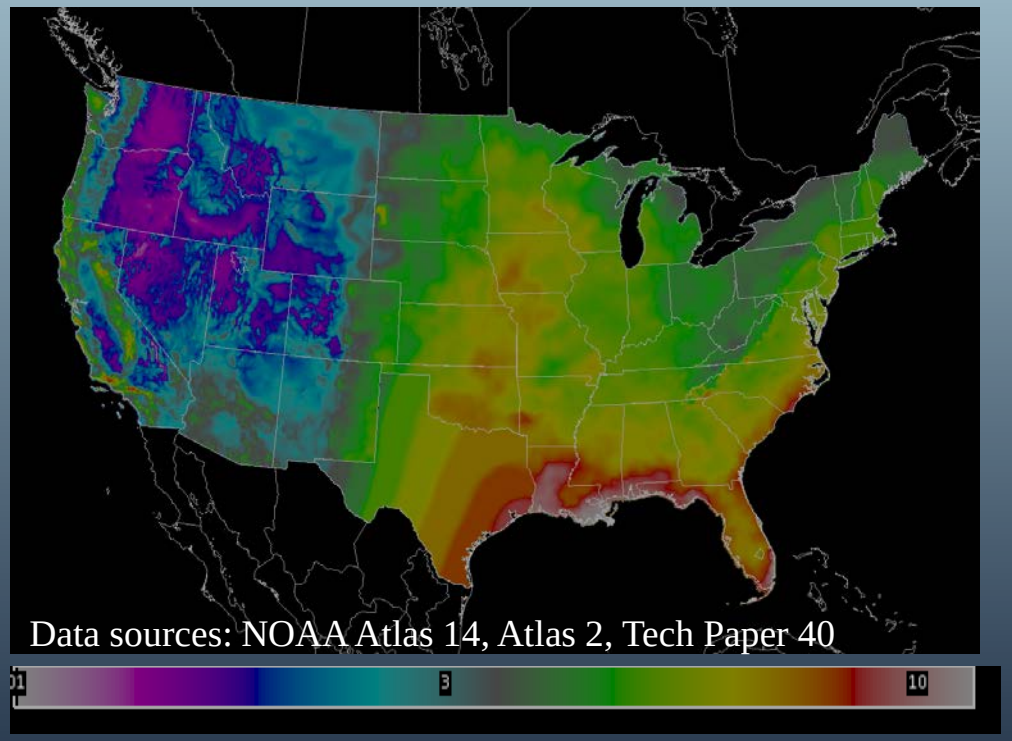
- Climatologically significant rainfall
- Antecedent conditions

2. Consult experts on extreme precipitation

3. Consider design concept and data sources leveraged



100-yr ARI, 6 hr duration



ARI Review

Average Recurrence Interval (ARI)

→ The **average** or expected value of the periods (years) between exceedances of a given **rainfall** total accumulated over a given duration.

- **Rainfall ARIs ≠ Flooding ARIs**

NOAA Atlas-14

→ Most recent, comprehensive dataset providing point-based, precipitation frequency estimates (inches) associated with a given ARI

"AEP"

ARI (years)	Probability of occurrence in any given year	Percent chance of occurrence in any given year
1000	1 in 1000	0.1%
500	1 in 500	0.2%
100	1 in 100	1%
50	1 in 50	2%
20	1 in 20	5%
10	1 in 10	10%
5	1 in 5	20%
2	1 in 2	50%
1	1 in 1	100%

ARI data can be used to:

Compare to observations (QPE) and forecasted rainfall (QPF) → measures the rarity or extreme nature of a rainfall event → Ideal for IDSS

Why use ARIs?

Research → Test → Implement → Improve

Culverts → 5-50+ ARI

Rural levees → 2-50 yr ARI

Small Dams → 50-100 ARI

Large Dams → 100+ ARI

Table 10.3.1 Generalized Design Criteria for Water-Control Structures

Type of Structure	Return Period (Years)	ELV
Highway culverts		
Low traffic	5–10	—
Intermediate traffic	10–25	—
High traffic	50–100	—
Highway bridges		
Secondary system	10–50	—
Primary system	50–100	—
Farm drainage		
Culverts	5–50	—
Ditches	5–50	—
Urban drainage		
Storm sewers in small cities	2–25	—
Storm sewers in large cities	25–50	—
Airfields		
Low traffic	5–10	—
Intermediate traffic	10–25	—
High traffic	50–100	—
Levees		
On farms	2–50	—
Around cities	50–200	—
Dams with no likelihood of loss of life (low hazard)		
Small dams	50–100	—
Intermediate dams	100 +	—
Large dams	—	50–100%
Dams with probable loss of life (significant hazard)		
Small dams	100 +	50%
Intermediate dams	—	50–100%
Large dams	—	100%
Dams with high likelihood of considerable loss of life (high hazard)		
Small dams	—	50–100%
Intermediate dams	—	100%
Large dams	—	100%

Source: Chow et al. (1988).

ARI Research

Research → Test → Implement → Improve

Dr. Russ Schumacher and Greg Herman (Colorado State University)

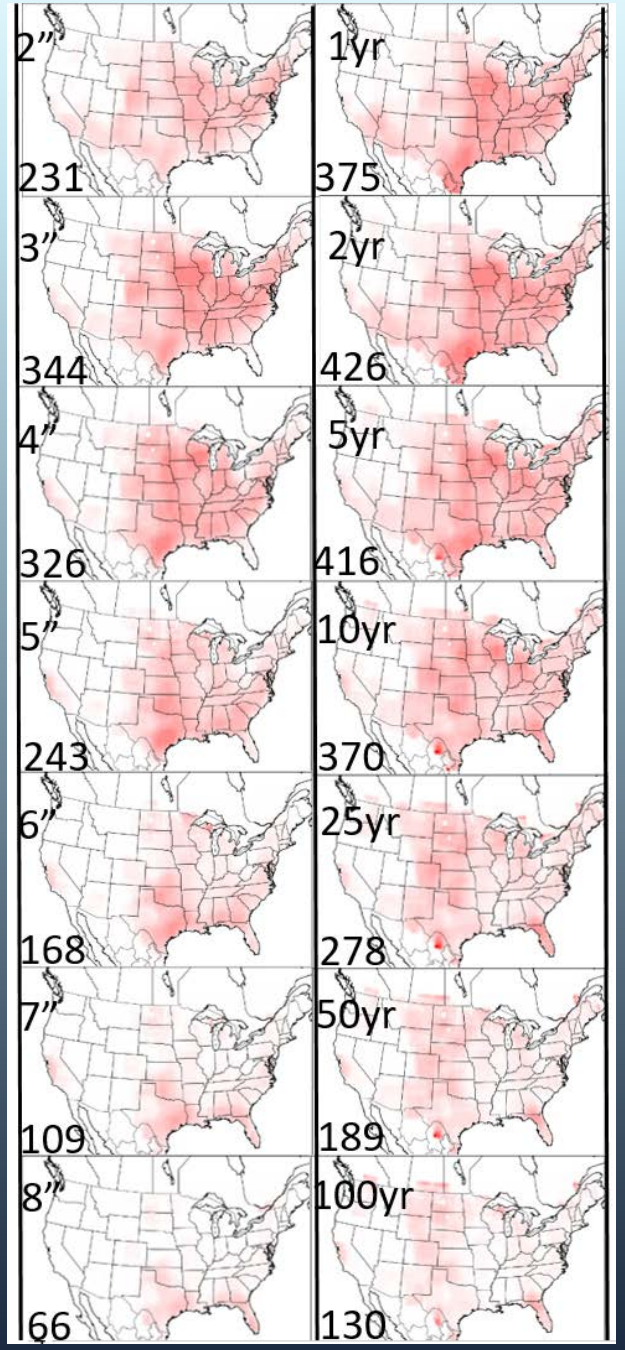
- ARIs are generally better correlated with FF reports compared to a fixed QPF threshold.
- Results are regionally dependent; some regions like the Northern Great Plains show that a fixed exceedance threshold of 2.5 in/24 hrs correspond best to FF reports.

Scott Lincoln at (Sr. Hydro.-LMRFC) and Rachelle Thomason (intern-LMRFC)

- 2-yr ARI could be used for warning threshold
- 25-yr ARI could indicate major flooding

Rich Grumm (SOO-CTP)

- GFS tends to under forecast 6-hour QPF amounts for top 1% events → QPF/100-yr ARI ratios over 70% are difficult to achieve
- Forecasters should be **mindful** of extreme rainfall potential when the 6-hour QPF/100-yr ARI ratios are over 50%
- Forecasters should be **concerned** about an extreme event as the values approach and exceed 70%.
- Values near 100% are rare and often **indicate extreme rainfall and higher end flooding**.



Design, Data, and Platform

Research → **Test** → Implement → Improve

Extreme Precipitation Forecast Table (EPFT)

- Design → Situational Awareness Table → Highlight climatologically significant rainfall
- Data → NOAA Atlas 14 Average Recurrence Intervals
- Platform → AWIPS→ Large source of QPF guidance → Can be utilized by WFOs, RFCs, and WPC, and Regions

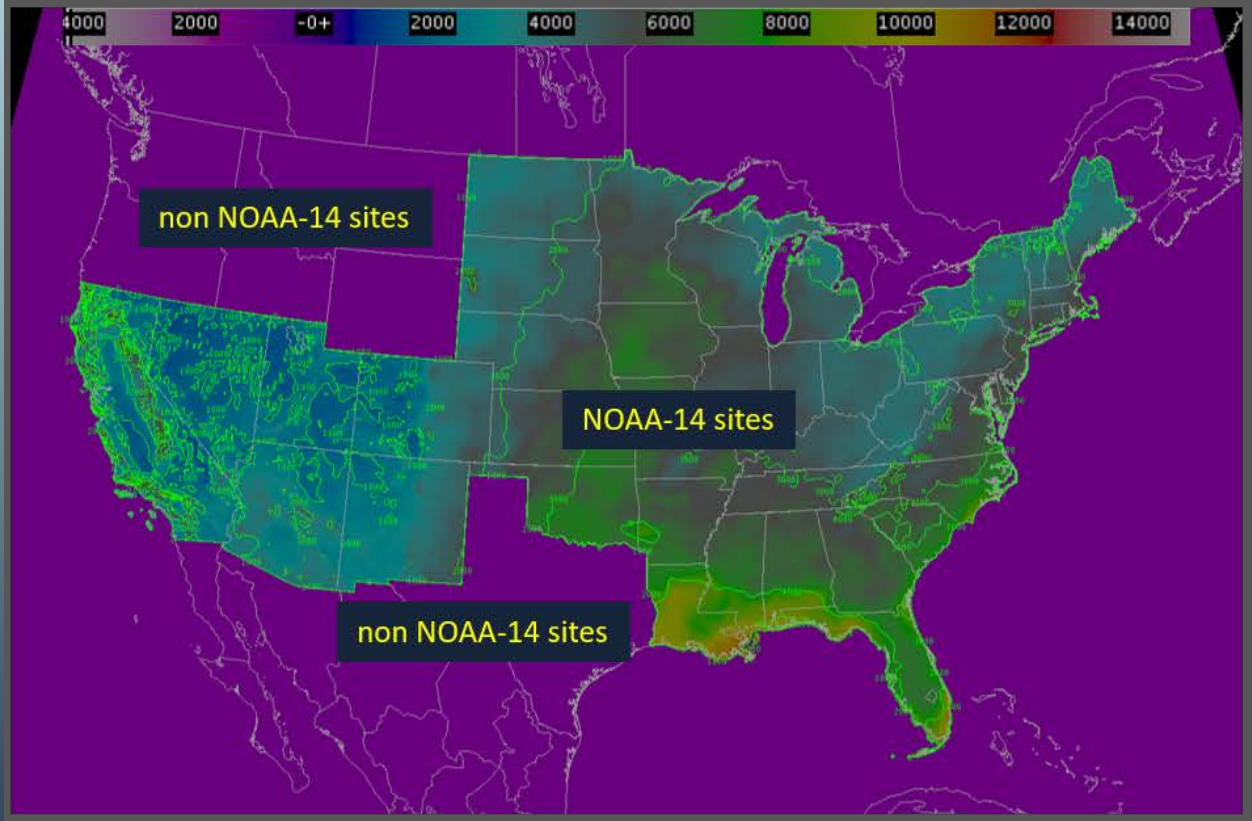
File Duration (max[QPF/ARI] *100)

	(Wed)		Jun 23 (Thu)				Jun 24 (Fri)				Jun 25 (Sat)				Jun 26 (Sun)			
	2	18	06	12	18		06	12	18		06	12	18		06	12	18	
ECMWFHiRes	11	11	8	8	9	9	13	13	10	10	7	7	16	16	9	9	16	16
GEFSMEAN		12	19	24	30	21	19	16	15	18	10	15	10	9	13	16	10	5
HIRESWarw	53	75	94	109	33													
HIRESWnmm	90	71	89	96	68													
HPCERP		20	35	40	23	36	21	10	25	23	17	20	4	8	8	6	2	2
NAM12	20	35	36	96	53	51	43	33	64	56	76	65						
NDFD	11	18	29	26	18	19	18	9	9									

ARIs in AWIPS

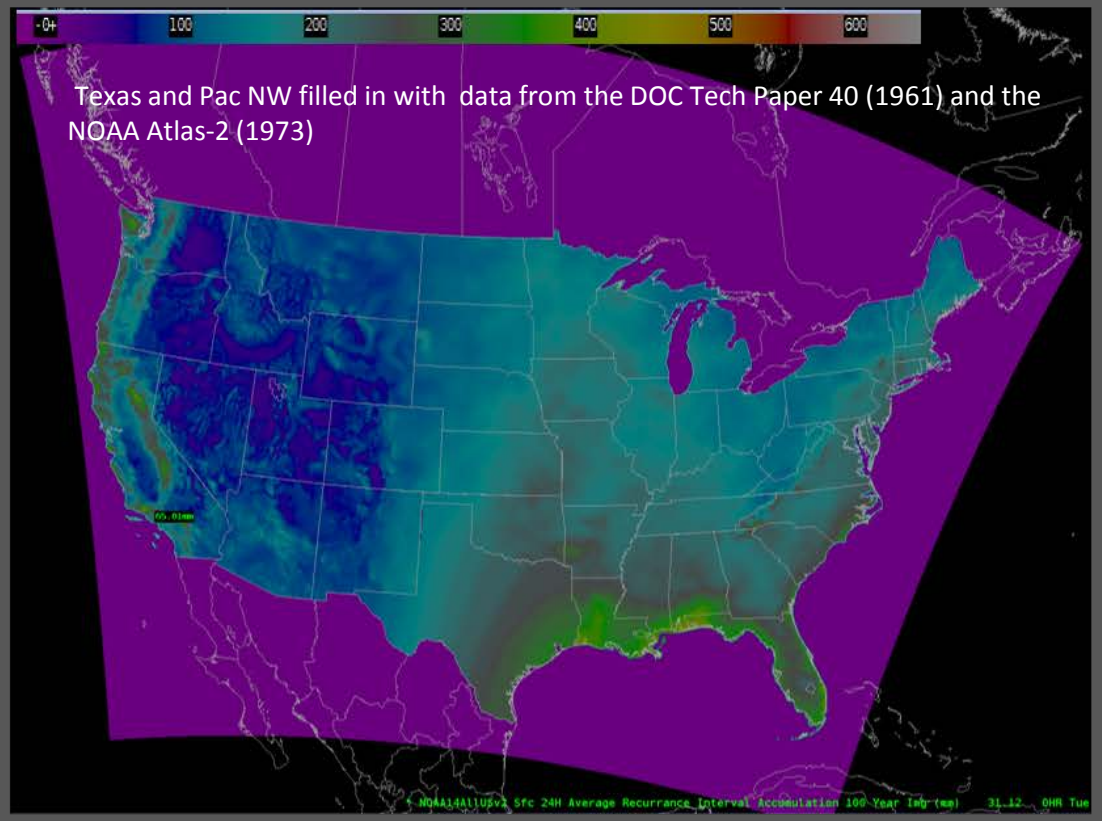
Research → **Test** → Implement → Improve

NOAA14Atlas



NOAA14Atlas available data in AWIPS:
ARIs: 1, 2, 5, 10, 25, 50, 100, 200, 500, and 1000 years
Durations: 30 min, 1-, 2-, 3-, 6-, 12-, and 24-hrs

NOAA14AllUSv2



NOAA14AllUSv2 available data in AWIPS:
ARIs: 1, 2, 5, 10, 25, 50, and 100 years
Durations: 6- and 24-hrs

Test Case - EWX

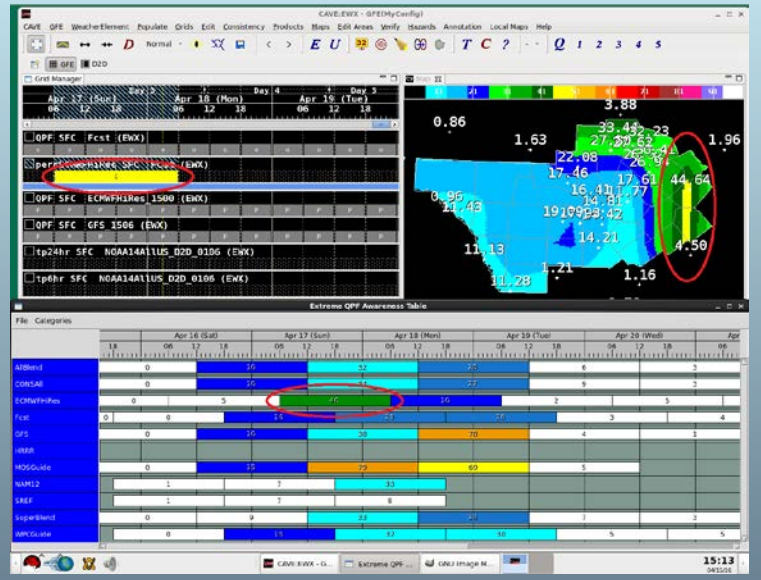
Research → **Test** → Implement → Improve

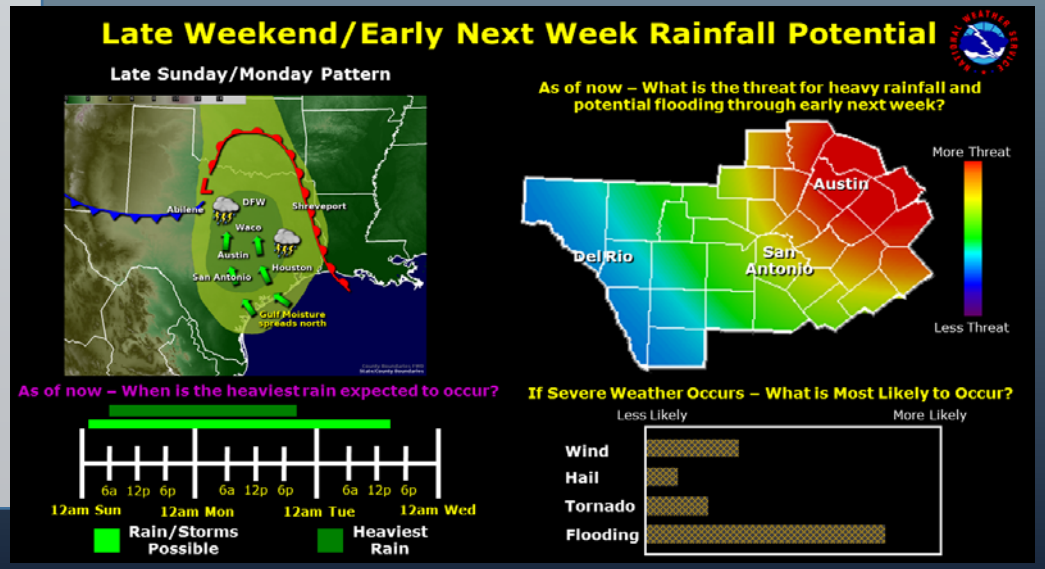
Use and Calibration
Jon Zeitler (SOO-EWX)

- Use the EPFT as a “one stop shop” tool to check for rarity and consistency
- Antecedent conditions are not considered → Overlay low water crossings, burns scars, areas of high streamflow, etc. to highlight potential trouble areas
- Create IDSS graphics that highlight extreme nature of event and confidence

QPF/ARI*	Potential for Damaging Impacts to Life and Property**
< 25%	Minimal
25-50%	Low
50-75%	Moderate
75-100%	High
100-125%	Very High
125-150%	Emergency
150-175%	Catastrophic

*Compared to the 100-year ARI rainfall estimates for durations of 6- and 24-hours
**Impacts from flooding also depend on soil moisture and type, terrain, areal coverage of rainfall, and geography (urban vs. rural).



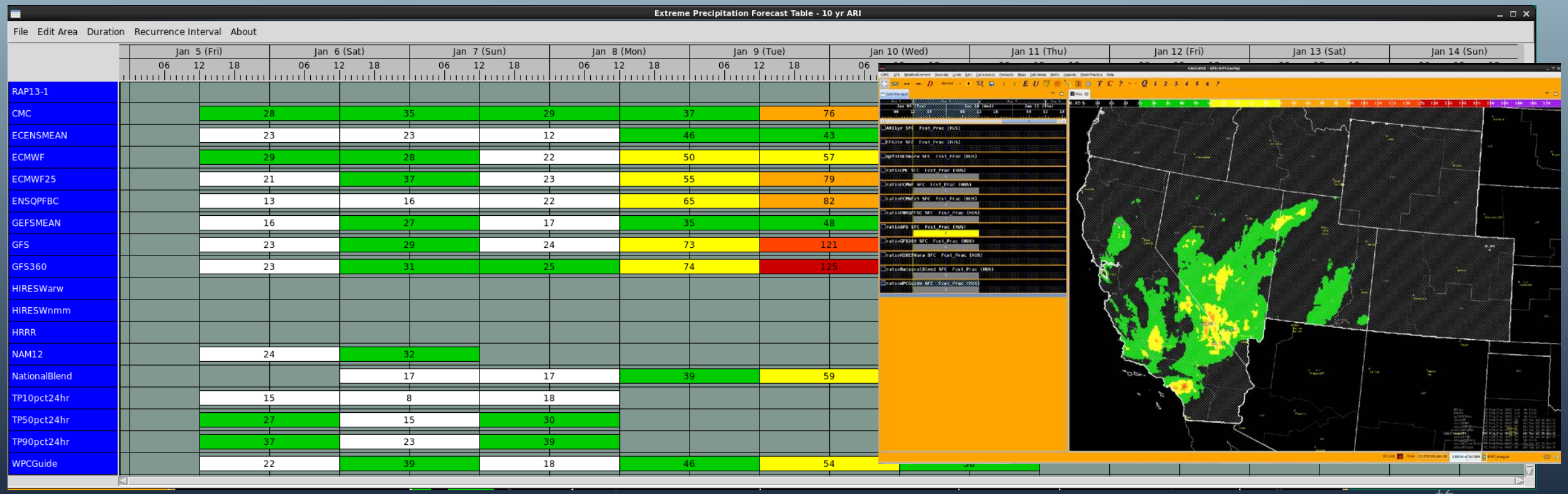


Operational Implementation

Research → Test → **Implement** → Improve

The EPFT and NOAA-14 data for GFE was uploaded to the Vlab/SCP on July 2016

https://vlab.ncep.noaa.gov/redmine/projects/nwsscp/wiki/AriInstallPackage
https://vlab.ncep.noaa.gov/redmine/projects/nwsscp/wiki/ExtremePrecipForecastTable



Operational Implementation

Research → Test → **Implement** → Improve

Extreme Precipitation Forecast Table (EPFT)

- Introduced to operations July 2016
- Table displays → max[QPF/ARI] *100
- Used by WFOs, RFCs, and WPC

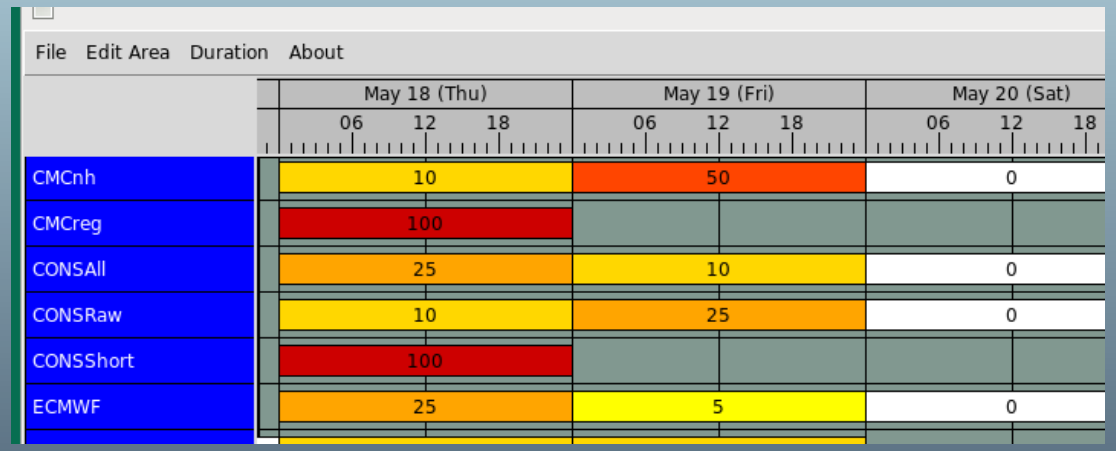
Average Recurrence Interval Table (ARIT)

- Introduced February 2017
- Table displays → max[ARI]

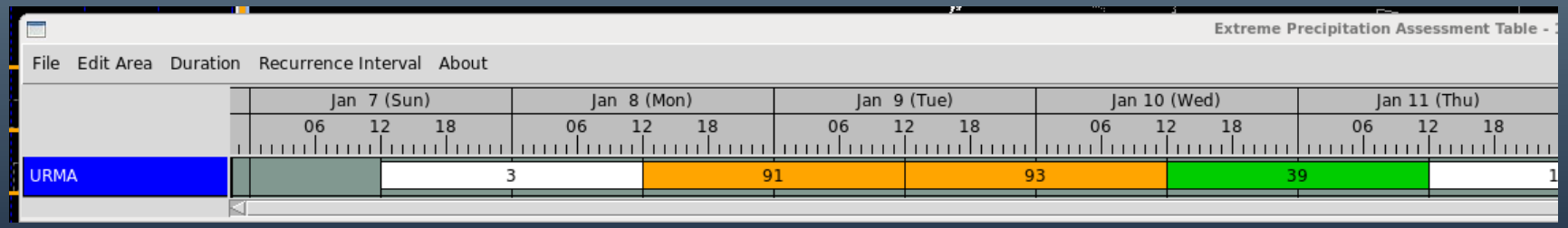
Extreme Precipitation Assessment Table (EPAT)

- Introduced February 2017
- Table displays → max[QPE/ARI] *100

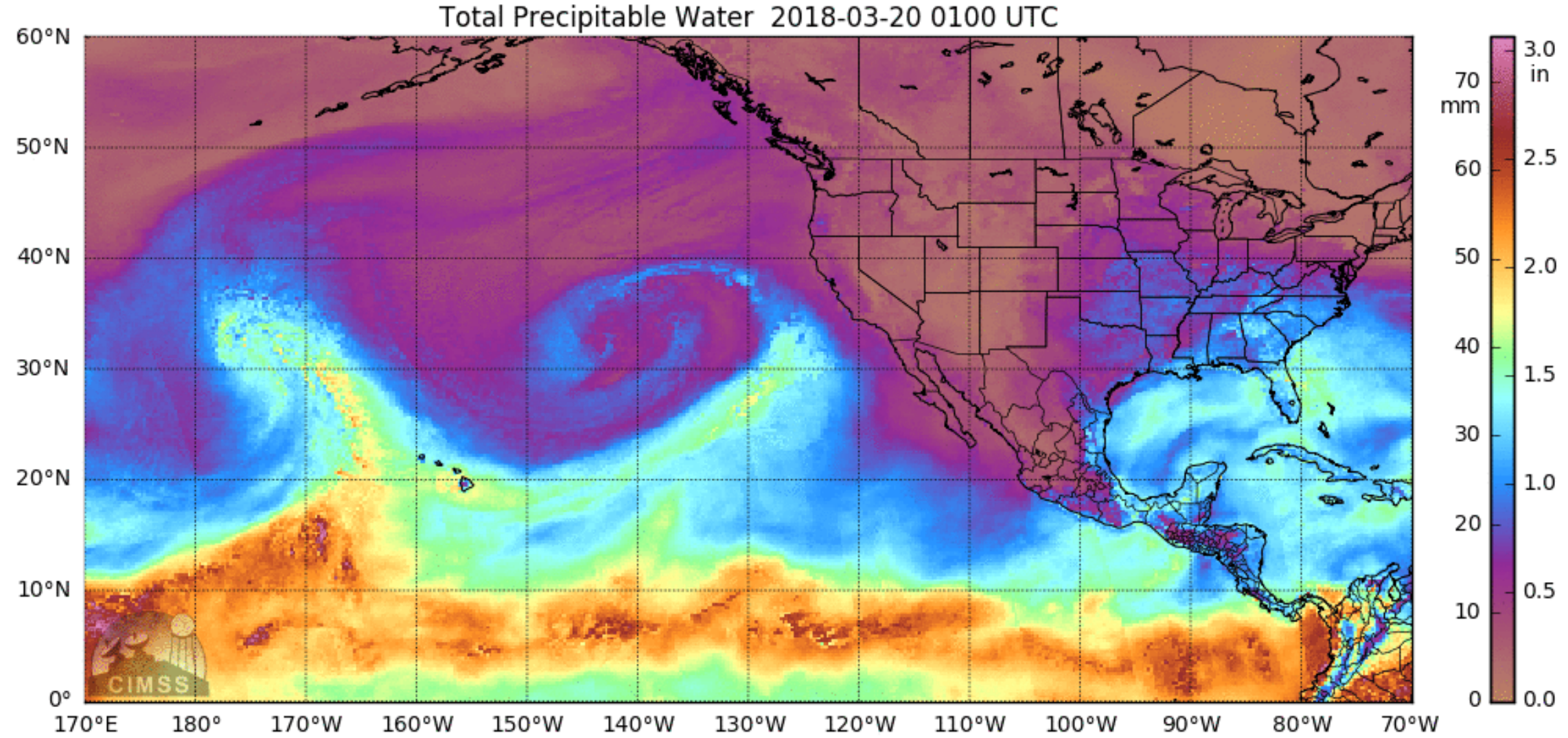
ARIT



EPAT



March 21-22 AR Event



NoMachine - WPC

CAVE:HUS - GFE(WPCConfig)

CAVE GFE WeatherElement Populate Grids Edit Consistency Products Maps Edit Areas Verify Hazards Reset Practice Help

Normal

Grid Manager

Today | Tonight | Tomorrow Night | Day 3 | Day 4

3/18 Mar 19 (Mon) Mar 20 (Tue) Mar 21 (Wed) Mar 22 (Thu) 3/23

06 12 18

ratioCMC SFC Fcst_Prac (HUS)

ratioECMWF SFC Fcst_Prac (HUS)

ratioECMWF25 SFC Fcst_Prac (HUS)

ratioENSQPFBC SFC Fcst_Prac (HUS)

ratioGFS SFC Fcst_Prac (HUS)

ratioGFS360 SFC Fcst_Prac (HUS)

ratioNAM12 SFC Fcst_Prac (HUS)

Map

0.00 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170

Extreme Precipitation Forecast Table - 100 yr ARI

File Edit Area Duration Recurrence Interval About

	Mar 20 (Tue)				Mar 21 (Wed)				Mar 22 (Thu)				Mar 23 (Fri)				Mar 24 (Sat)				Mar 25 (Sun)				Mar 26 (Mon)				Mar 27 (Tue)				Mar 28 (Wed)				Mar 29 (Thu)			
	3	06	12	18	06	12	18		06	12	18		06	12	18		06	12	18		06	12	18		06	12	18		06	12	18		06	12	18		06	12	18	
Fcst-1	10	0	0	8	32	22	21	22	32	29	20	20	18	24	17	11	14	9	6	5	7	7																		
NDFD-1	5	3	4	21	38	26	16	20																																
CMC	2	1	2	7	34	25	27	16	15	41	58	66	44	39	41	33	23	52	19	22	27	15	6	15	8	11	14	14	15	31	26	13	14	11	15	8	14	16		
ECENSMEAN	3	0	2	6	13	15	13	14	17	25	36	33	28	21	19	20	15	12	10	9	6	5	4	3	4	5	4	3	4	4	2	2	3	3	2	2				
ECMWF	5	1	2	6	13	17	31	27	20	37	38	68	61	39	53	39	29	29	25	20	21	19	9	10	7	3	6	10			6									
ECMWF25	3	3	1	5	24	23	36	27	19	43	57	66	97	51	61	45	49	27	25	22	25	21	14	10	8	7	5													
ENSQPFBC	1	0	1	8	22	21	19	28	29	43	52	54	39	30	18	24	24	21	9	8	10	7	6	1	3	1	1	1	1	7	5	1								
GEFSMEAN	6	6	5	6	22	26	22	26	26	31	39	38	36	29	21	22	19	13	10	8	7	5	5	4	5	4	4	3	5	6	3	2	6	6	3	5	9	8		
GFS	8	7	4	22	39	40	41	40	53	55	53	71	52	35	39	29	28	32	19	20	22	15	13	2	1	1	0	1	7	16	14	18	23	19	28	16	24	33		
GFS360	11	11	4	24	41	36	52	44	51	56	82	84	99	58	64	43	43	27	29	31	28	22	13	3	2	1	0	1	14	24	18	23	32	41	38	47	68	41		
MOSGuide		0	1	7	22	47	36	48	42	42	41	65	38	24	14	15	13	24	16	5	9	4	1	0																
NAM12	10	7	8	6	20	45	34	27	45	45	59	81																												
NAMNest																																								
NationalBlend		2	6	9	29	24	17	22	18	20	27	30	24																											
TP10pct6hr				1	1	4	9	9	10	11																														
TP50pct6hr				2	6	16	18	15	15	18																														
TP90pct6hr				3	11	41	24	26	29	27																														
WPCGuide	8	2	2	8	18	23	19	19	23	45	60	49	36	24	22	19	16	10	7	6	6	3	2	2	2	2	2													

[Terminal] CAVE:HUS - GFE(WPC... Extreme Precipitation ...

19:05
03/19/18

NoMachine - WPC

CAVE:HUS - GFE(WPCConfig)

CAVE GFE WeatherElement Populate Grids Edit Consistency Products Maps Edit Areas Verify Hazards Reset Practice Help

Grid Manager

3/18 Mar 19 (Mon) Mar 20 (Tue) Mar 21 (Wed) Mar 22 (Thu) 3/23

Today Tonight Tomorrow Night Day 3 Day 4

ratioCMC SFC Fcst_Prac (HUS)

ratioECMWF SFC Fcst_Prac (HUS)

ratioECMWF25 SFC Fcst_Prac (HUS)

ratioENSQPFBC SFC Fcst_Prac (HUS)

ratioGFS SFC Fcst_Prac (HUS)

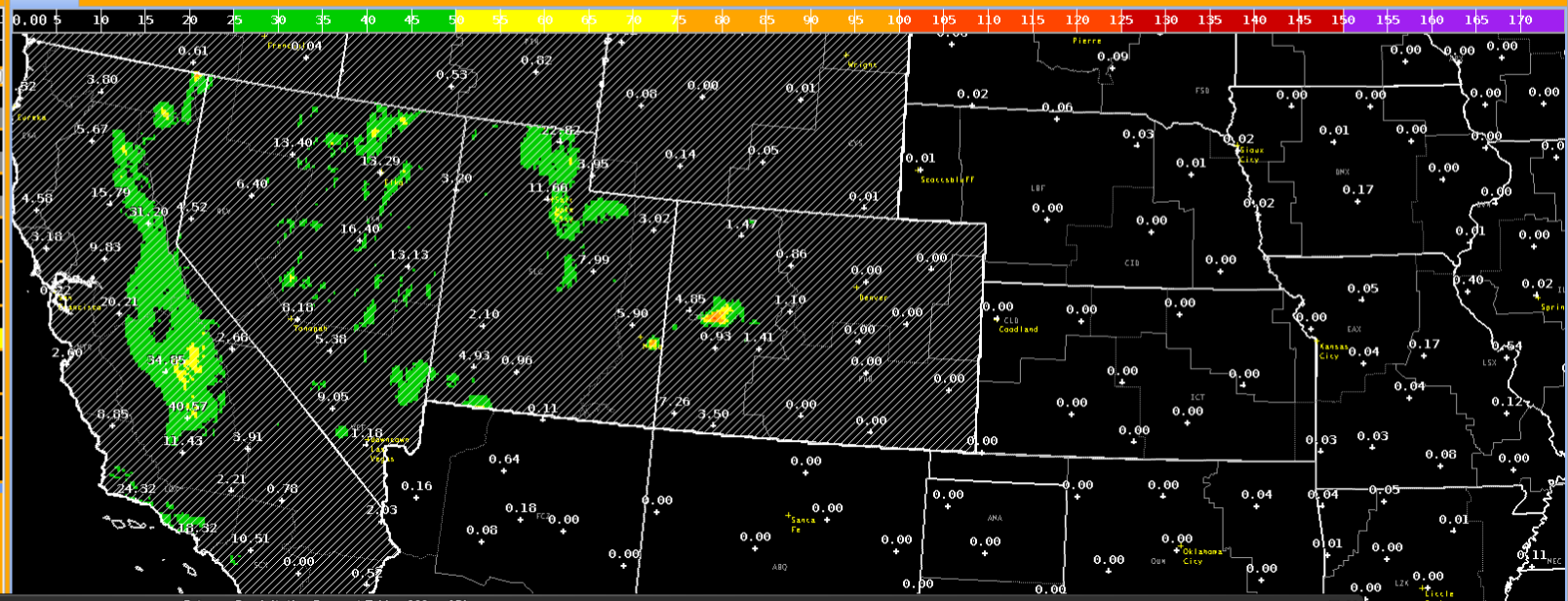
ratioGFS360 SFC Fcst_Prac (HUS)

ratioMOSGuide SFC Fcst_Prac (HUS)

ratioNAM12 SFC Fcst_Prac (HUS)

ratioWPCGuide SFC Fcst_Prac (HUS)

Map



Extreme Precipitation Forecast Table - 100 yr ARI

File Edit Area Duration Recurrence Interval About

	Mar 20 (Tue)	Mar 21 (Wed)	Mar 22 (Thu)	Mar 23 (Fri)	Mar 24 (Sat)	Mar 25 (Sun)	Mar 26 (Mon)	Mar 27 (Tue)	Mar 28 (Wed)	Mar 29 (Thu)
Fcst-1	7	24	40	40	17					
NDFD-1		33								
CMC		36	69	90	71	33	12	36	23	
ECENSMEAN		21	43	56	26	14	10	7	6	
ECMWF		20	49	76	43	25	15	14	26	
ECMWF25		34	52	102	52	29	18	15		
ENSQPFBC		27	77	68	33	8	2	6		
GEFSMEAN		41	61	57	33	13	8	8	10	
GFS		47	85	74	42	23	2	12	41	
GFS360		44	83	100	65	24	3	22	50	
MOSGuide		60	102	52	27	7				
NAM12		35	68							
NAMNest										
NationalBlend		38	49							
TP10pct24hr		2	11	22						
TP50pct24hr		7	30	52						
TP90pct24hr		13	53	79						
WPCGuide		30	56	46	29	8	4			

[Terminal] CAVE:HUS - GFE(WPC... Extreme Precipitation ...

19:14 03/19/18

NoMachine - WPC

CAVE:HUS - GFE(WPCConfig)

CAVE GFE WeatherElement Populate Grids Edit Consistency Products Maps Edit Areas Verify Hazards Reset Practice Help

Grid Manager

Today | Tonight | Tomorrow | Tomorrow Night | Day 3 | Day 4 | Day 5

Mar 19 | Mar 20 (Tue) | Mar 21 (Wed) | Mar 22 (Thu) | Mar 23 (Fri) | 24

18 | 06 | 12 | 18 | 06 | 12 | 18 | 06 | 12 | 18 | 06 | 12 | 18

- ratioCMC SFC Fcst_Prac (HUS)
- ratioECMWF SFC Fcst_Prac (HUS)
- ratioECMWF25 SFC Fcst_Prac (HUS)
- ratioENSQPFBC SFC Fcst_Prac (HUS)
- ratioGEFSMEAN SFC Fcst_Prac (HUS)
- ratioGFS SFC Fcst_Prac (HUS)
- ratioGFS360 SFC Fcst_Prac (HUS)
- ratioMOSGuide SFC Fcst_Prac (HUS)
- ratioNAM12 SFC Fcst_Prac (HUS)
- ratioTP90pct24hr SFC Fcst_Prac (HUS)
- ratioWPCGuide SFC Fcst_Prac (HUS)

Map

0.00 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170

Extreme Precipitation Forecast Table - 100 yr ARI

File Edit Area Duration Recurrence Interval About

1 yr
2 yr
5 yr
10 yr
25 yr
50 yr
100 yr
500 yr
1000 yr

	Mar 20 (Tue)	Mar 21 (Wed)	Mar 22 (Thu)	Mar 23 (Fri)	Mar 24 (Sat)
NDFD-1	18				
Fcst-1	23	40	23	5	
ENSQPFBC-1	27	74	68	1	
CMC	29	69	90	16	
ECENSMEAN	19	43	36	5	
ECMWF	17	49	76	18	
ECMWF25	19	52	101	30	
GEFSMEAN	32	53	53	4	
GFS	47	72	74	3	
GFS360	39	73	66	5	
MOSGuide	60	102	52	3	
NAM12	34	68			
NAMNest					
NationalBlend	33	49			
TP10pct24hr		9	32		
TP50pct24hr		28	51		
TP90pct24hr		50	70		
WPCGuide	22	56	46	6	

[Terminal] CAVE:HUS - GFE(WPC... Extreme Precipitation ... Updating...

19:29 03/19/18

NoMachine - WPC

CAVE:HUS - GFE(WPCConfig)

CAVE GFE WeatherElement Populate Grids Edit Consistency Products Maps Edit Areas Verify Hazards Reset Practice Help

Grid Manager

Today | Tonight | Tomorrow | Tomorrow Night | Day 3 | Day 4 | Day 5

Mar 19 | Mar 20 (Tue) | Mar 21 (Wed) | Mar 22 (Thu) | Mar 23 (Fri) | 24

18 | 06 | 12 | 18

- ratioCMC SFC Fcst_Prac (HUS)
- ratioECMWF SFC Fcst_Prac (HUS)
- ratioECMWF25 SFC Fcst_Prac (HUS)
- ratioENSQPFBC SFC Fcst_Prac (HUS)
- ratioGEFSMEAN SFC Fcst_Prac (HUS)
- ratioGFS SFC Fcst_Prac (HUS)
- ratioGFS360 SFC Fcst_Prac (HUS)
- ratioMOSGuide SFC Fcst_Prac (HUS)
- ratioNAM12 SFC Fcst_Prac (HUS)
- ratioTP90pct24hr SFC Fcst_Prac (HUS)
- ratioWPCGuide SFC Fcst_Prac (HUS)

Map

Extreme Precipitation Forecast Table - 25 yr ARI

File Edit Area Duration Recurrence Interval About

	Mar 20 (Tue)	Mar 21 (Wed)	Mar 22 (Thu)	Mar 23 (Fri)	Mar 24 (Sat)
Fcst-1	0 / 32	54	29	6	
NDFD-1	24				
CMC	38	93	120	21	
ECENSMEAN	24	59	47	7	
ECMWF	22	63	99	23	
ECMWF25	25	68	132	41	
ENSQPFBC	40	98	103		
GEFSMEAN	45	72	69	5	
GFS	63	98	98	4	
GFS360	54	99	88	7	
MOSGuide	84	135	68	3	
NAM12	45	86			
NAMNest					
NationalBlend	46	65			
TP10pct24hr		11	43		
TP50pct24hr		39	68		
TP90pct24hr		69	97		
WPCGuide	31	75	59	8	

[Terminal] CAVE:HUS - GFE(WPC... Extreme Precipitation ... Updating...

19:35 03/19/18

NoMachine - WPC

CAVE:HUS - GFE(WPCConfig)

CAVE GFE WeatherElement Populate Grids Edit Consistency Products Maps Edit Areas Verify Hazards Reset Practice Help

Normal E U 32 T C ? Q 1 2 3 4 5 6 7

Grid Manager

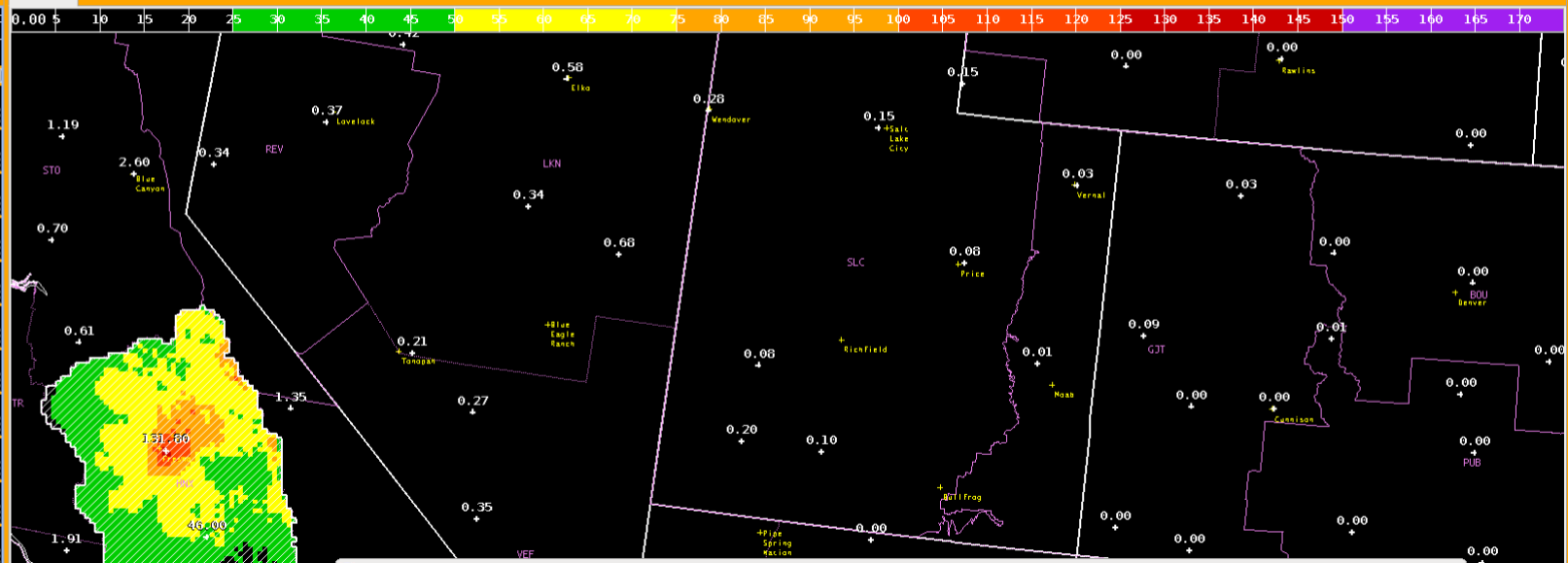
Today | Tonight | Tomorrow Night | Day 3 | Day 4 | Day 5

Mar 19 | Mar 20 (Tue) | Mar 21 (Wed) | Mar 22 (Thu) | Mar 23 (Fri) | 24

18 06 12 18 06 12 18 06 12 18 06 12 18

- ratioCMC SFC Fcst_Prac (HUS)
- ratioECMWF SFC Fcst_Prac (HUS)
- ratioECMWF25 SFC Fcst_Prac (HUS)
- ratioENSQPFBC SFC Fcst_Prac (HUS)
- ratioGEFSMEAN SFC Fcst_Prac (HUS)
- ratioGFS SFC Fcst_Prac (HUS)
- ratioGFS360 SFC Fcst_Prac (HUS)
- ratioMOSGuide SFC Fcst_Prac (HUS)
- ratioNAM12 SFC Fcst_Prac (HUS)
- ratioTP90pct24hr SFC Fcst_Prac (HUS)
- ratioWPCGuide SFC Fcst_Prac (HUS)

Map



Extreme Precipitation Forecast Table - 10 yr ARI

File Edit Area Duration Recurrence Interval About

	Mar 20 (Tue)	Mar 21 (Wed)	Mar 22 (Thu)	Mar 23 (Fri)	Mar 24 (Sat)
Fcst-1	0	41	68	35	7
NDFD-1		29			
CMC		46	114	148	26
ECENSMEAN		30	74	59	8
ECMWF		26	76	125	28
ECMWF25		31	87	150	52
ENSQPFBC		50	122	124	
GEFSMEAN		58	93	85	5
GFS		77	125	121	5
GFS360		68	126	109	8
MOSGuide		109	150	86	4
NAM12		57	103		
NAMNest					
NationalBlend		58	81		
TP10pct24hr			14	55	
TP50pct24hr			50	85	
TP90pct24hr			88	123	
WPCGuide		40	94	72	9

[Terminal] CAVE:HUS - GFE(WPC... Extreme Precipitation ... Updating...

19:39 03/19/18

NoMachine - WPC

CAVE:HUS - GFE(WPCConfig)

CAVE GFE WeatherElement Populate Grids Edit Consistency Products Maps Edit Areas Verify Hazards Reset Practice Help

Grid Manager

Today | Tonight | Tomorrow Night | Day 3 | Day 4 | Day 5

Mar 19 | Mar 20 (Tue) | Mar 21 (Wed) | Mar 22 (Thu) | Mar 23 (Fri)

- QPF2ARIECMWF25 SFC Fcst_Prac (HUS)
- ratioCMC SFC Fcst_Prac (HUS)
- ratioECMWF SFC Fcst_Prac (HUS)
- ratioECMWF25 SFC Fcst_Prac (HUS)
- ratioENSQPFBC SFC Fcst_Prac (HUS)
- ratioGEFSMEAN SFC Fcst_Prac (HUS)
- ratioGFS SFC Fcst_Prac (HUS)
- ratioGFS360 SFC Fcst_Prac (HUS)
- ratioMOSGuide SFC Fcst_Prac (HUS)
- ratioNAM12 SFC Fcst_Prac (HUS)
- ratioTP90pct24hr SFC Fcst_Prac (HUS)
- ratioWPCGuide SFC Fcst_Prac (HUS)

Map

Extreme Precipitation Forecast Table - 10 yr ARI

File Edit Area Duration Recurrence Interval About

	Mar 20 (Tue)	Mar 21 (Wed)	Mar 22 (Thu)	Mar 23 (Fri)	Mar 24 (Sat)
Fcst-1	0	41	68	35	7
NDFD-1		29			
CMC		46	114	148	26
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GFS		77	125	121	
GFS360		68	126	109	
MOSGuide		109	150	86	
NAM12		57	103		
NAMNest					
NationalBlend		58	81		
TP10pct24hr			14	55	
TP50pct24hr			50	85	
TP90pct24hr			88	123	
WPCGuide		40	94	72	9

te

ARI

QPF

Contour ARI

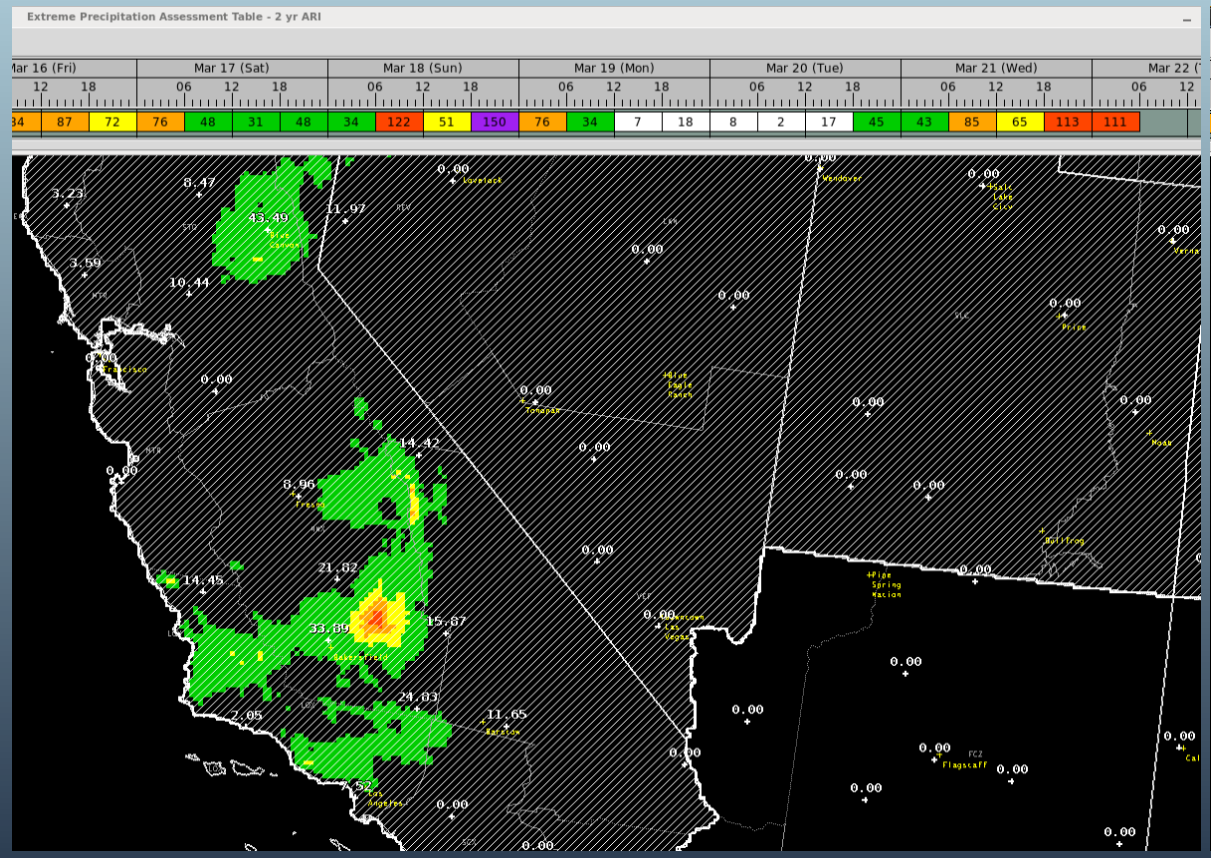
[Terminal] | CAVE:HUS - GFE(WPC... | Extreme Precipitation ... | Updating...

19:41

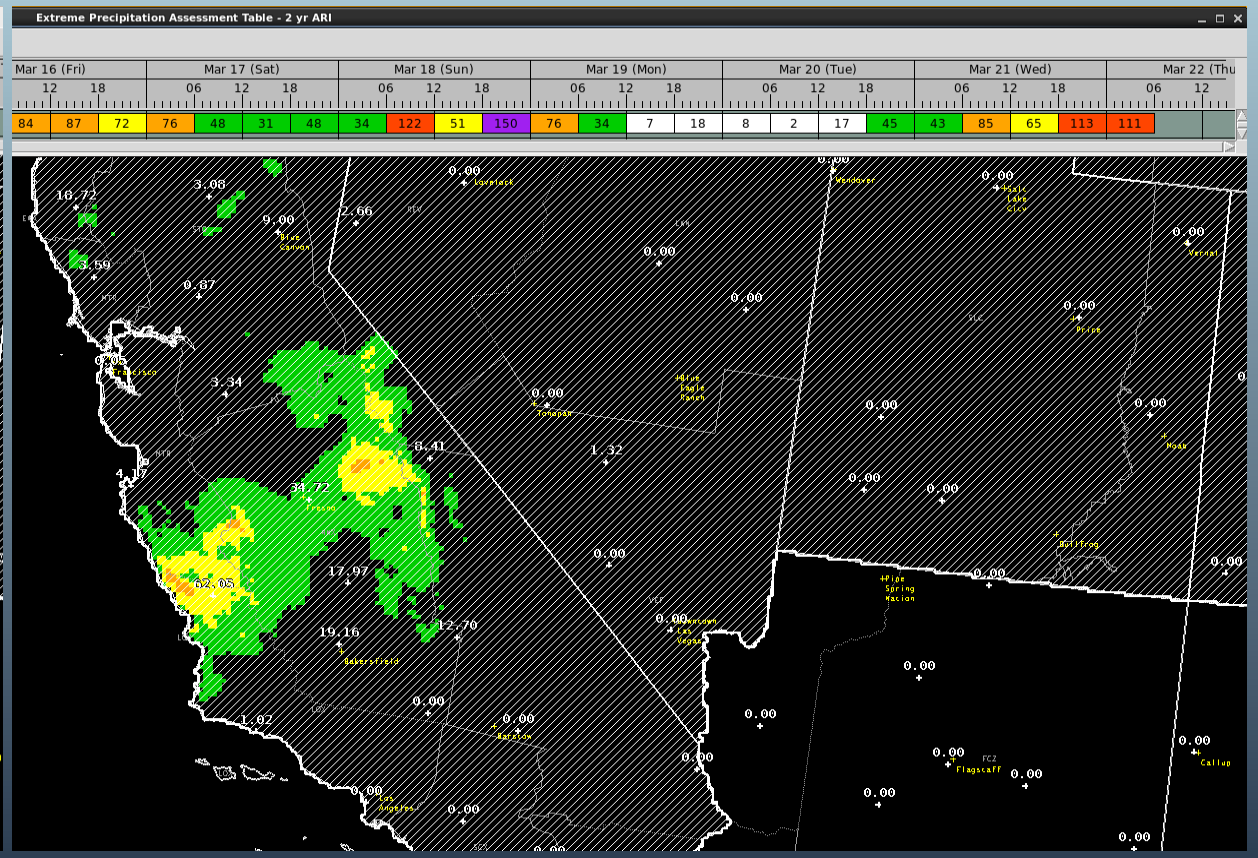
03/19/18

Extreme Precipitation Assessment Table
6-hr, 2 yr ARI

18-00Z March 21



00-06Z March 22



Recent Improvements

Research → Test → Implement → **Improve**

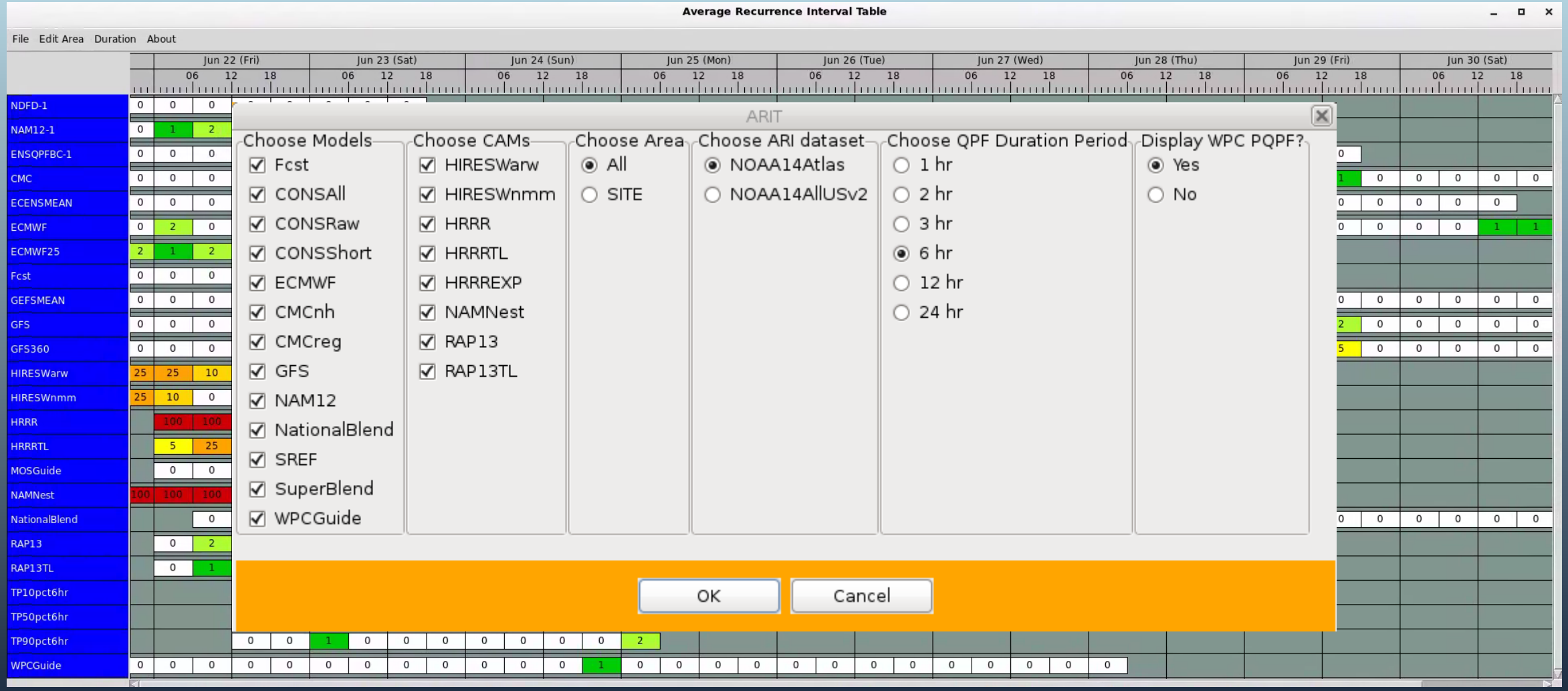
Addition of:

- WPC's probabilistic quantitative precipitation forecast (PQPF) → QPF associated with the 10th, 50th, and 90th percentiles from an ensemble of 46-members (SREF, GEFS, ECMWF, NAM, GFS, WRF-ARW/NMM)
  - WPC guidance is the mode, variance comes from the ensemble
  - 6- and 24-hr forecasts available
- Can be used by forecasters and hydrologists to determine the probability of climatologically significant or extreme rainfall at a given location.
- Can be used to identify where model guidance exists in the spread of probabilities assessed by WPC.

NationalBlend			38	49		
TP10pct24hr			2	11	22	
TP50pct24hr			7	30	52	
TP90pct24hr			13	53	79	
WPCGuide			30	56	46	

Recent Improvements

The new and improved ARIT…

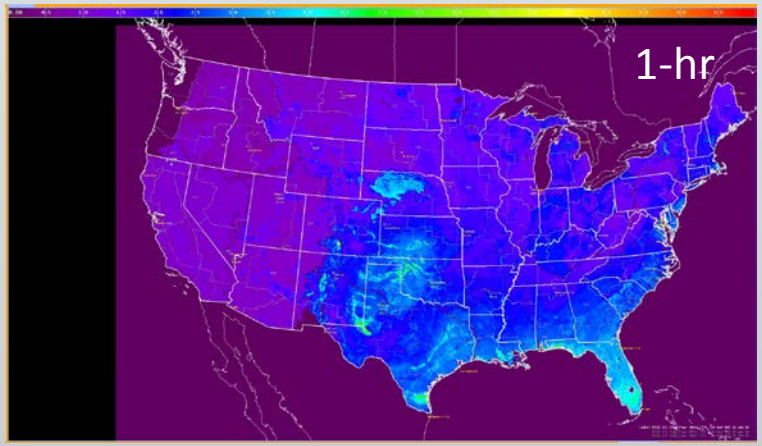


Future Improvements and Enhancements

Research → Test → Implement → **Improve**

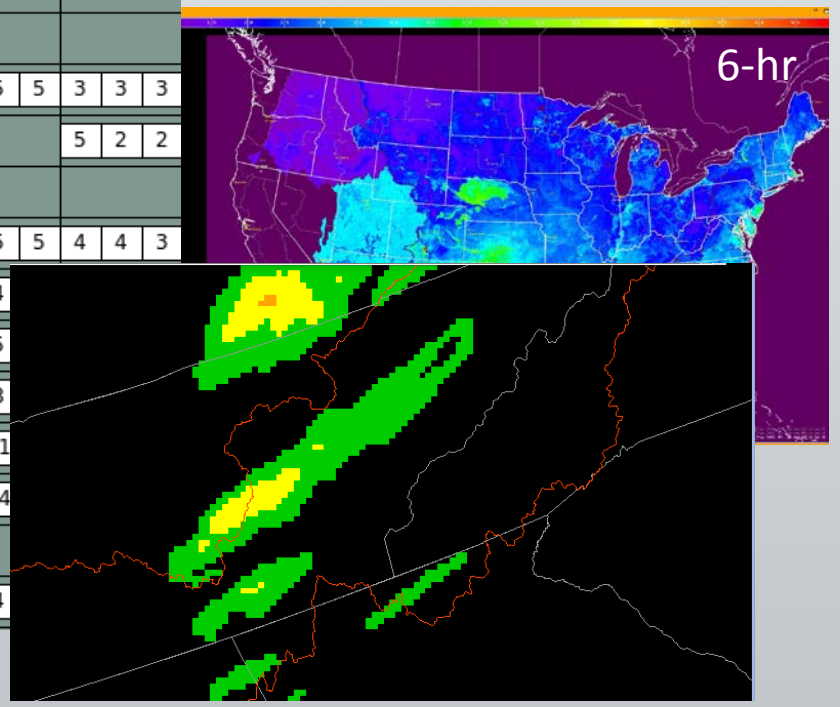
Improvements

- Flash Flood Guidance for improved s



File Edit Area Duration Recurrence Interval About

	Mar 20 (Tue)											Mar 21 (Wed)						
	18			06		12		18				06		12		18		
HRRR-1	55	55	52	57	59													
HRRR-1	55	55	52	57	59													
NationalBlend-1		22	22	23	23	17	17	9	9	15	15	9	9	5	5	3	3	3
CMCnh	17	24	27	39	28						26					5	2	2
CMCreg	38	40	42	46	48	22	14	22	27									
ECMWF	10	19	19	16	16	15	15	7	7	21	21	7	7	5	5	4	4	3
Fcst	20	24	24	24	24	13	13	7	7	8	8	7	7	4				
GFS		23	23	24	24	20	20	8	8	19	19	10	10	5				
HIRESWarw	90	62	71*	81*	59	35	42	46	17	27	38	11	8	8				
HIRESWnmm	45	58	47	63	45	48	32	20	11	21	17	13	9	11				
NAM12	34	44	49	48	40	27	31	16	28	12	25	25	21	14				
RAP13		37	40	37														
SREF	19	17	12	12	13	15	10	4	4	5	7	10	5	4				



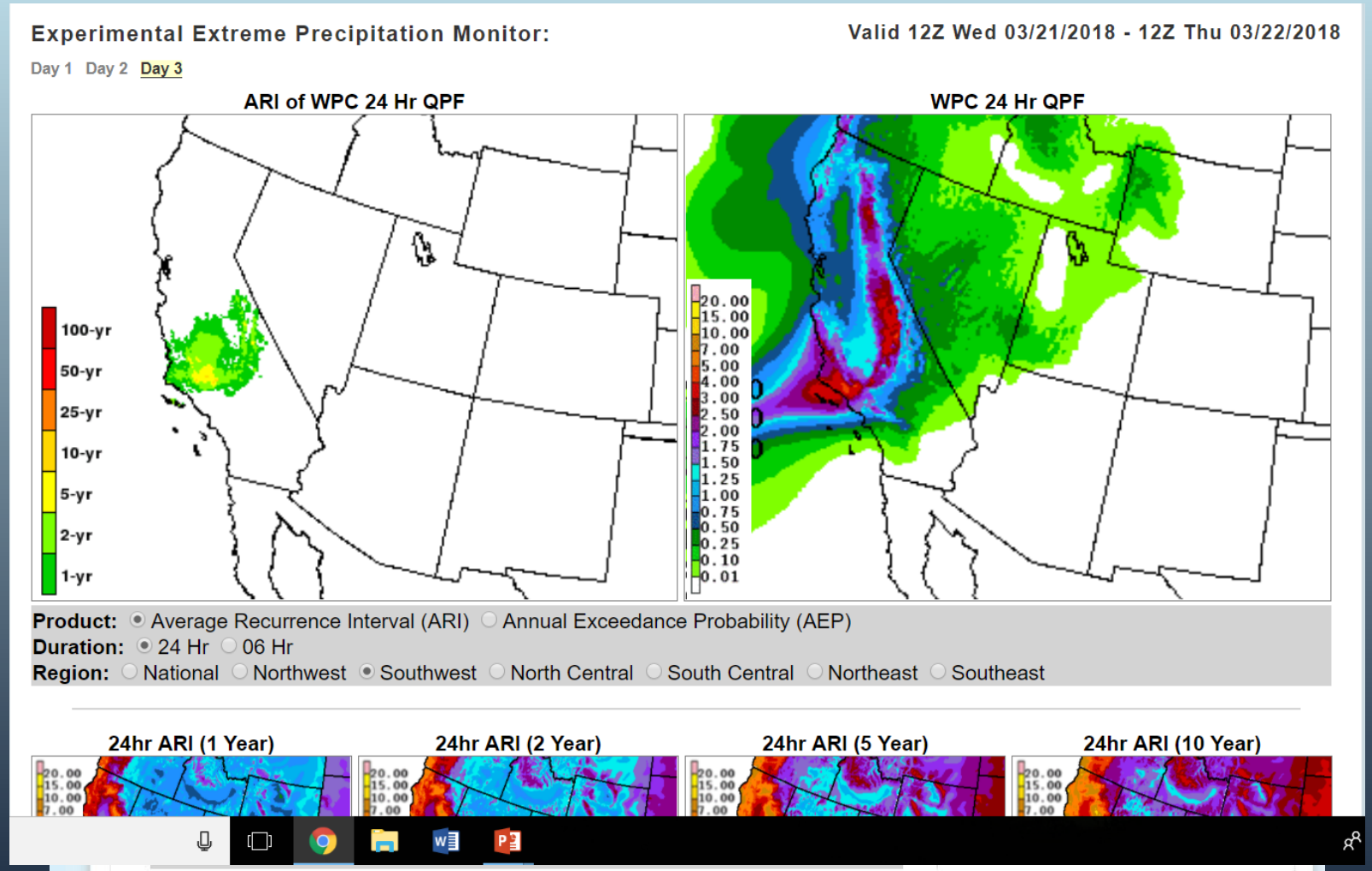
Enhancements/Additions

- Longer duration ARIs (2-day, 3-day, 5-day)
- Probability of ARI Exceedance (non-bias corrected → model relative frequency)
- Anomalous meteorological ingredients analysis
- Improved design for short-term precip, flash-flood producing situations

Extreme Precipitation Monitor

http://www.wpc.ncep.noaa.gov/qpf/epm/extreme_precip_monitor.php

- Displays climatological significance of rainfall forecasted by the Weather Prediction Center
- Generated with WPC's Day 1-3 QPF for each 6- and 24-hour period and precipitation estimates from the NOAA Atlas-14
- Each contour level represents the ARI/AEP equivalent of QPF expected to be equaled or exceeded during the specified time period.



Web-based EPFT

(In Progress)

Model Run: Jul 16, 2018 00Z | **Table Region:** Continental U.S. | **Plot Region:** Continental U.S. | **Duration:** 6 hour | **ARI:** 100 year | View Table

WFO Continental U.S. Table Jul 16, 2018 00Z Run

			GFS	ECMWF
6	Mon 16th	06Z	58.0	15.0
12		12Z	49.0	19.0
18		18Z	44.0	17.0
24	Tue 17th	00Z	48.0	34.0
30		06Z	74.0	22.0
36		12Z	32.0	46.0
42		18Z	34.0	30.0
48	Wed 18th	00Z	90.0	52.0
54		06Z	88.0	24.0
60		12Z	36.0	21.0
66		18Z	33.0	23.0
72	Thu 19th	00Z	31.0	25.0
78		06Z	51.0	17.0
84		12Z	45.0	18.0
90		18Z	40.0	40.0
96	Fri 20th	00Z	28.0	31.0
102		06Z	90.0	27.0
108		12Z	38.0	24.0
114		18Z	15.0	28.0
120	Sat 21st	00Z	56.0	22.0

How to navigate:

On the main table: Click a field (e.g., 'Z'
Click a value (e.g., '2.8') to plot a multi-panel

On a sub-table: Click a value (e.g., '2.8')
Click a level (e.g., '500') to loop images for t

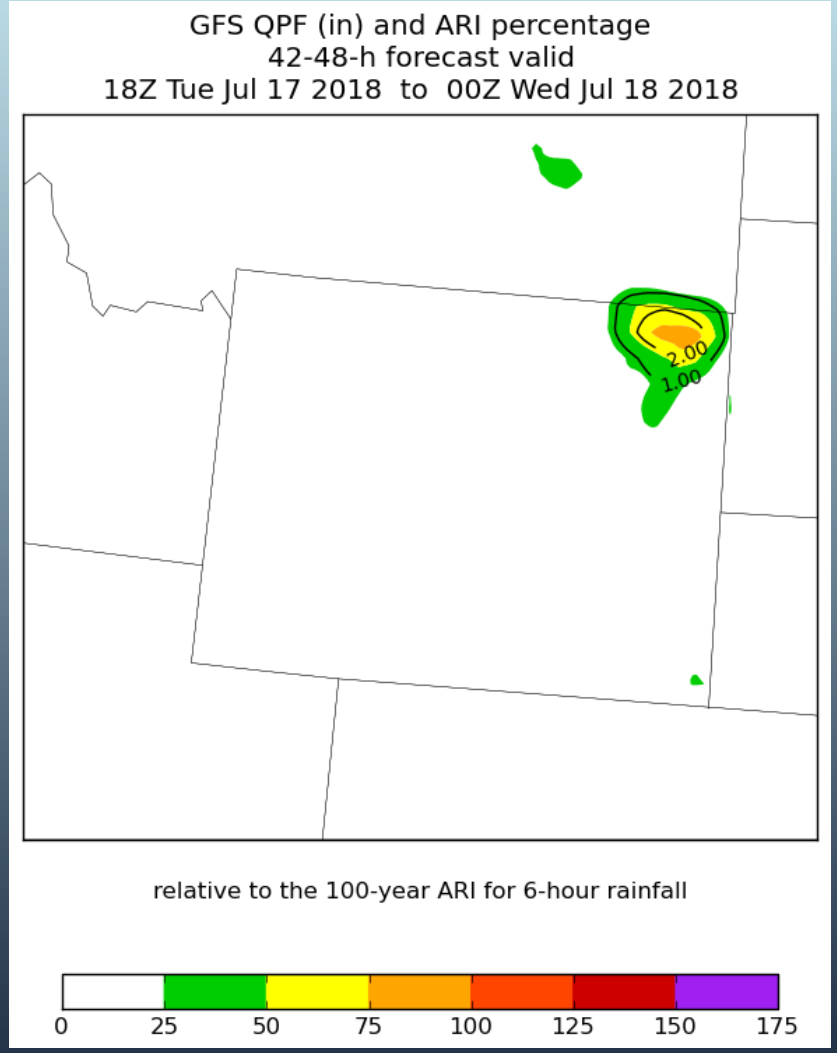
For a different table: Select the desired
drop-down menus above, and click View Tab

The ECMWF Ensemble: A 51-member
run and 50 members with different initial con
native resolutions of 18 km, the ECMWF EN

ECMWF ENS Standardized Anomaly:
climatological mean? Compares the ECMW
standard deviation derived from the 1979-20
anomaly = (ECMWF_ENS_forecast - CFSR
(CFSR_climatology_standard_deviation)

ECMWF ENS Percentile (Recommend
to climatology? Example: MAX at 00Z indica
greater than all 00Z values in the CFSR clim
Forecasters are encouraged to focus on "MA
forecasting an event that would fall outside t

ECMWF ENS Return Interval: How oft
Specifically, how often were the CFSR value
extreme than values in the ECMWF ENS for
that roughly every 5 years, there is a day in



*In collaboration with Bill Lamberson (WPC)

Challenges moving forward…

ARIs are still widely misunderstood by the Public.

Hurricane Matthew 2017 NWS Service Assessment
"Difficulty in communicating the inland flooding threat is not a new issue and has appeared repeatedly in previous service assessments."

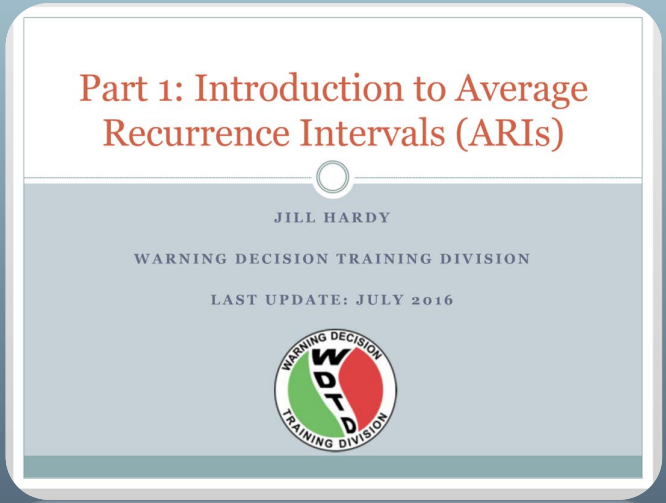
"Partners indicated that despite the excellent service and information provided by the NWS they were surprised at the magnitude of flooding they experienced and did not feel that the threat was communicated adequately."

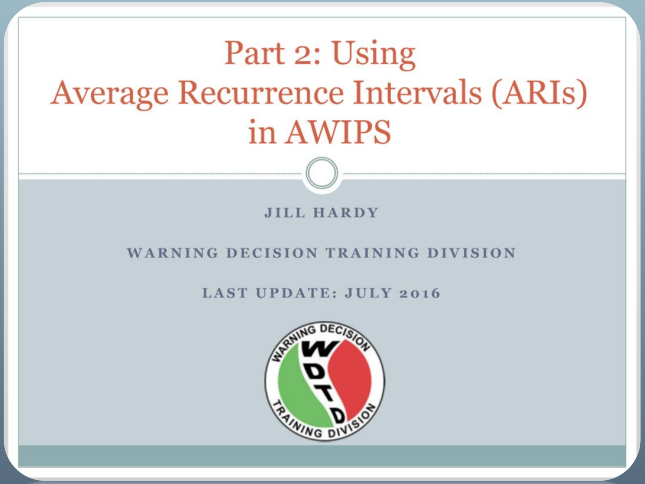
More research needed to link ARIs to impacts.

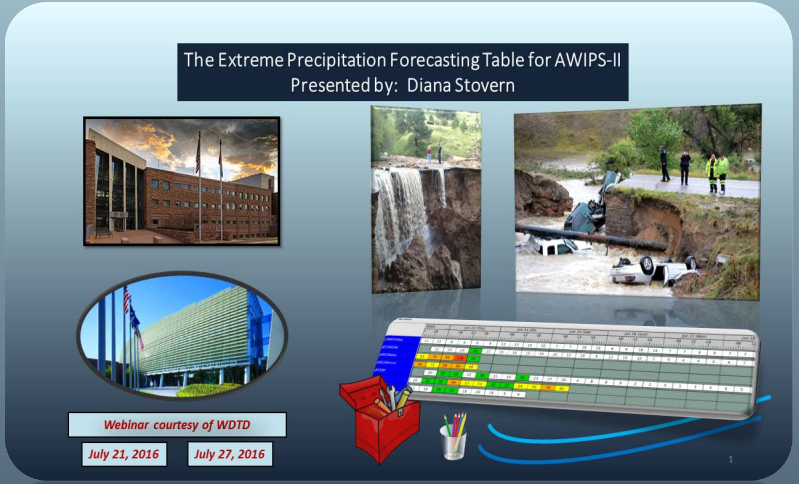
The NOAA Atlas 14 is a relatively new dataset just starting to gain traction in the NWS. Continued use, training, and research linking specific ARIs to impacts is needed to optimize ARIs as a situational awareness tool.

Training

Available on the Commerce Learning Center (CLC)







Thank you!

Dr. Diana Stovern (diana.stovern@noaa.gov)

ARI data → https://vlab.ncep.noaa.gov/redmine/projects/nwsscp/wiki/AriInstallPackage

EPFT → https://vlab.ncep.noaa.gov/redmine/projects/nwsscp/wiki/ExtremePrecipForecastTable

ARIT → https://vlab.ncep.noaa.gov/redmine/projects/nwsscp/wiki/AverageRecurrenceIntervalTable

EPAT → https://vlab.ncep.noaa.gov/redmine/projects/nwsscp/wiki/ExtremePrecipAssessmentTable

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